
How to Use Computer Graphics to Promote Virtual Idols Based on 3D

by Chuanshi Qin

A Thesis submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Fine Arts in Computer Graphics Design

Supervised by

Associate Professor Chris Jackson
Department of Computer Graphics Design
School of Design
College of Imaging Arts and Sciences
Rochester Institute of Technology
Rochester, NY
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Approvals

Chief Advisor: Chris Jackson, Associate Professor, Computer Graphics Design

Signature of Chief Advisor

Date

Associate Advisor; Shaun Foster, Visiting Professor, Computer Graphics Design

Signature of Associate Advisor

Date

Associate Advisor; Nancy Doubleday, Associate Professor, Information Technology

Signature of Associate Advisor

Date

School of Design Chairperson:

Patti Lachance, Associate Professor, School of Design

Signature of Administrative Chairperson

Date

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Master of Fine Arts

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Abstract

Computer Graphics is developing rapidly day by day and 3D technology is becoming a more and more important part of art and design. 2D animation has its own beauty that I really appreciate. However, I believe that 3D cartoon characters can be the virtual idols mainly produced in the future.

My thesis project is a combination of many kinds of design. The essential one is character design for sure because it is something that all the other kinds of design in this project come from. The motion graphics design and website design are the key part of this project because these two aspects determine this project is successful or not.

The characters are designed in a way that combines the Hollywood animation style and the Japanese anime style. Motion graphics pieces of this project are designed into very bright and delight ones. The motion graphics animations are done in MAYA and After Effects, while the website is done in FLASH.

Thesis Website: <http://www.qinchuanshi.com/thesis/index.htm>

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PART ONE

THESIS PROJECT DOCUMENT

Documentation: Thesis Project for Master of Fine Arts Degree

How to Use Computer Graphics to Promote Virtual Idols Based on 3D

Rochester Institute of Technology

College of Imaging Arts and Sciences School of Design

Computer Graphics Design

How to Use Computer Graphics to Promote Virtual Idols Based on 3D

By Chuanshi Qin

January 01 2009

1. PROFILE

Name: Chuanshi Qin (Chance)

Degree: Bachelor of Engineering 2006 (Computer Science) + Master of Fine Art 2008 (Computer Graphics Design)

Web: <http://www.qinchuanshi.com>

Email: qinchuanshi@hotmail.com

I am a 23 years old student from China at Rochester Institute of Technology studying Computer Graphics Design. I am very interested and passionate in Motion Graphics and 3D design. Besides doing character design in my spare time I love creating motion graphics and web and strive toward excellence in these fields.

2. INTRODUCTION

2.1 Background

Inspired by the movie, “Simone“, released in 2002, I decided to design a whole package for promoting virtual idols. In the movie, the virtual character, Simone, was actually played by a real actress named Rachel Roberts. While this 3D girl became very famous and popular as a result of the movie, in reality, 3D-based characters are not that widely loved.

There are too many failed examples of 3D virtual idols planning in this world. There’s no doubt that plenty of the 2D characters also do not get to market. The truth is that the famous 2D virtual idols are more popular for a longer period of time.

The goal of this project is to make two 3D characters into virtual idols. They will not only be just cartoon characters, but they will be life like, and they will actually “live” in this world. The only difference is their appearance as they will not grow old unless the promotional strategy requires the character to change over time.

The 3D animation is going to receive the most of the marketing attention during a very short period of time. My goal is to design and create a promotion package for the 3D virtual idols using a combination the computer graphics design and marketing. To achieve this, initial focus is in understanding the difference between 2D and 3D, along with the concepts of virtual idol and cartoon characters as well as media and promotional packaging.

2.2 2D and 3D

2D computer graphics are the computer-based generation of digital images—mostly from two-dimensional models (such as 2D geometric models, text, and digital images) and are graphics that are not created within a space that has a true third dimension (depth/Z). This term represents a branch of Computer Science comprising of graphic design techniques, along with the models themselves. The most well-known 2D characters are Mickey Mouse and Donald Duck. 2D cartoon characters have been in the market for a long time and still possess beauty and values of their own.

3D computer graphics (in contrast to 2D computer graphics) are graphics that use a three-dimensional representation of geometric data that is stored in the computer for the purposes of performing calculations and rendering 2D images. Despite these differences, 3D computer graphics rely on many of the same algorithms as 2D computer vector graphics in the wire-frame model and 2D computer raster graphics in the final rendered display. The most famous 3D characters are Shrek, Kungfu Panda, along with other characters created by Pixar in their motion pictures.

In this project, I am concentrating on the difference between 2D and 3D computer graphics. As such, clay animation and puppets will not be considered at this time.

2.3 Virtual Idol and Cartoon Character

Idols are man-made objects generated in some way with virtual idols mostly being computer generated. With heavy promotion, it is possible for idols to become popular celebrities in and of themselves, "worshipped" by teenagers and merchandised by singers or actors. In addition, they can be promotional speakers for products as well as hosts for TV shows. Virtual idols are mostly

considered as computer generated idols with Japan being the first country producing them. The best known virtual idol, Simone, from the movie of the same name. However, Simone is considered a fake virtual idol because the role is actually played by a real super model.

Cartoon characters are fictional characters created in cartoons, including comic books, mangas, animes and TV series or movie animations. The first animated cartoon in the traditional sense(that is to say, on film) was "Fantasmagorie" by the French director Émile Cohl. Released in 1908 and the characters appearing in this movie were created by simple chalk-painted lines. There are now tons of cartoon characters from all around the world and in almost every field. For example, the world famous Mickey Mouse, the formal announcer for Japan's Hello Kitty, and even the Bibendum, the cute character made for Michelin Tires.

In my opinion, the biggest difference between a virtual idol and a cartoon character is the function. A virtual idol should be created for itself while a cartoon character is something for a specific project, such as a movie, an animation, or even a corporation.

2.4 Media and Promotion Package

Media refers to a communication method with the purpose of delivering information to the public. New media is a term encompassing the emergence communication methods using technologies developed during the latter part of the 20th century. Promotion Package refers to a package designed with the purpose of promoting a variety of products and services such as TV shows, products, movies, and even a country.

3. PROJECT DESCRIPTION

3.1 Objective

This project includes two motion graphics pieces along with a website for promoting two virtual idol characters expressly created for this project. The first step is to determine the content (text, graphics, and media) to be included on the website as part of the promotional package. Then, what kind of motion graphics should be suitable and workable for the characters. This involves design of the character, identification of motion graphics pieces, then design of a website for promoting the entire package.

3.2 Example Researches

There are not many cartoon characters that have been made with the express purpose of transforming them into virtual idols. As such, I researched and studied Hatsune Miku, who is the first and most popular installment in the Vocaloid Character Vocal Series, a singing synthesizer application produced by Yamaha.

Hatsune Miku's original Japanese name (初音ミク) is somewhat of a word play. Her name is made from the characters “未来” (Miku, Future), “初” (Hatsu, First), and “音” (Ne, Sound). Beginning with her release in August 2007 Hatsune Miku has gained a great deal of attention, mainly as a result of the Japanese video streaming site Nico Nico Douga. Even now, months after the original release new videos and songs of her singing are still being made and published online every day. Hatsune Miku was mostly designed to be a virtual singer first but since she became very popular later on, she has appeared in a few advertisements.

3.3 Thesis Project

I love animation very much and as a result of my concentration in motion graphics at Rochester Institute of Technology, I want to incorporate characters into my projects. Character animation and motion graphics can make each other even better when the animator can combine the two in the right way. That is one of the reasons why I chose this thesis topic. The goal of this project is to create promotional packages for marketing virtual idols so future studies have an example to follow and basic process for executing it.

This project defines the entire development process; from character design and development to execution of a promotional package.

01. Character Design - This activity covers idea gathering, sketches, 3D modeling, as well as texturing and rigging for both the motion graphics pieces and other categories of the thesis.

02. Motion Graphics Design - This activity is about the two openings for the two imagined TV show which I designed to be hosted by the characters I made. In this activity, readers learn the process of making a motion graphics piece, story boarding, frame styling and making the animation.

03. Product Design - This activity identifies and records promotional material specifically designed to market the characters, including T-shirts, mugs, hats, pins and key chains.

04. Web Design - This activity, which is one third of the project, allows readers to review my projects and understand the scope and purpose of my thesis.

4. CHARACTERS

4.1 Introduction

The first and the most important aspect of this thesis is character design as the two characters are the subject from which all other elements are created for incorporation into the promotion package. From the moment I decided on the topic, I wanted to bring both the Japanese and American style into my characters. In addition, prior to sketching my characters, it is important to ensure I can model the design in MAYA and animate them in the correct way.

Since I am creating two virtual idols to actually "live" in this world, they go to real schools, they stay in real cities and they can be spokesperson for real brands. I did not experience much trouble in obtaining the idea as I have always dreamed of opening my own motion graphics studio as a result of working with one of my best friends two years ago in directing and producing a 2D animation. We were called the kevil cat and the cool pig, I didn't know where these names came from but I think it's a good idea to create two characters based on our nick names.

As I have mentioned before, both of the characters are "living" in this world so it's obvious that they have their profiles, or in another way, biographies. Vinny is the character I created from the original "piggy". He is a British freelance artist, best known for his TV show "Dynamic Duo" and "Daily Gamer" that he does with Kawa.

Vinny was born in Edinburgh, UK, and raised in London, where his family settled in 1989. His father is a drug dealer. Vinny graduated from Streamthan & Clapham High School in London, UK in 1998. He then attended the University of London, Brown St, graduating in 2004 with a BA degree in Arabic. He

is single and dying to get a girl friends.

Vinny moved to the United States after watching the movie "Harold and Kumar". After spending all his money eating White Castle burgers, he started selling hand-made Arabic textbooks. He became an office boy at NBC in 2005. Very soon, he joined the infamous night shows group.

In 2006, he left NBC and became a member of the local QCS TV station and began his career as a host.

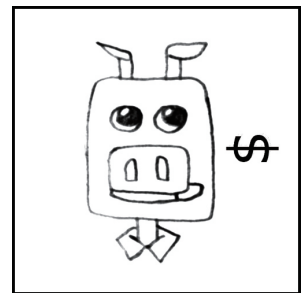
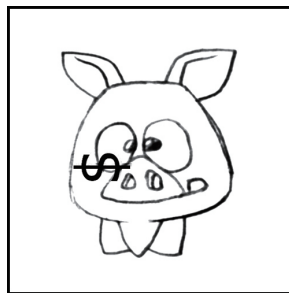
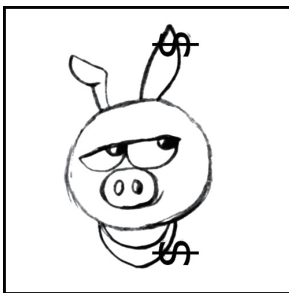
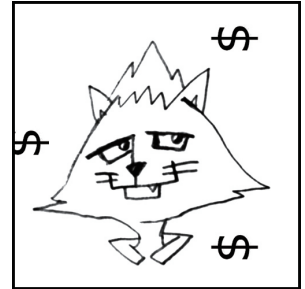
Kawa is the character I created from the original name "kitty". He is a Japanese manga artist and novelist, best known for his TV show "Dynamic Duo" and "Daily Gamer" that he does with Vinny. He is also publisher of his manga "Someday in Heaven".

Kawa was born in Osaka, Japan, and raised in Sendai, where his single mother settled there as a mama-san in 1990. Kawa graduated from Shirayuri High School in Sendai, Japan in 2000. He then attended the Kyoto Institute of Technology, graduating in 2004 with a BS degree in Computer Science. According to himself, he is still single even currently he has four girl friends.

Kawa moved to the United States because he heard that his father is in Buffalo, NY. Kawa found a job as an illustrator at a magazine company and in 2005, he opened a small Japanese restaurant. In 2006, he sold his restaurant to a Russian gang and became a member of the local QCS TV station and began his career as a host.

4.2 Design (from sketch to 3D)

Once I made up my mind to create the two characters to look like a pig and a cat, I started my sketching immediately. In the first versions of my design, I made their looks exactly close to the animals they represent. I did several attempts in one day for a whole week but was still not satisfied with any of them. Something always bothered me at the time and I could not identify what it was.



The character design was stuck until Christmas. It was then I accidentally erased the pig's nose a little and noticed that it was the animal's nose that troubled me all the time. I then realized that I did not have to make the characters to look exactly like a cat or piggy, I can just create them as some cat and pig look-alike creature since the most important thing was to give an interesting look, not an exact animal face.



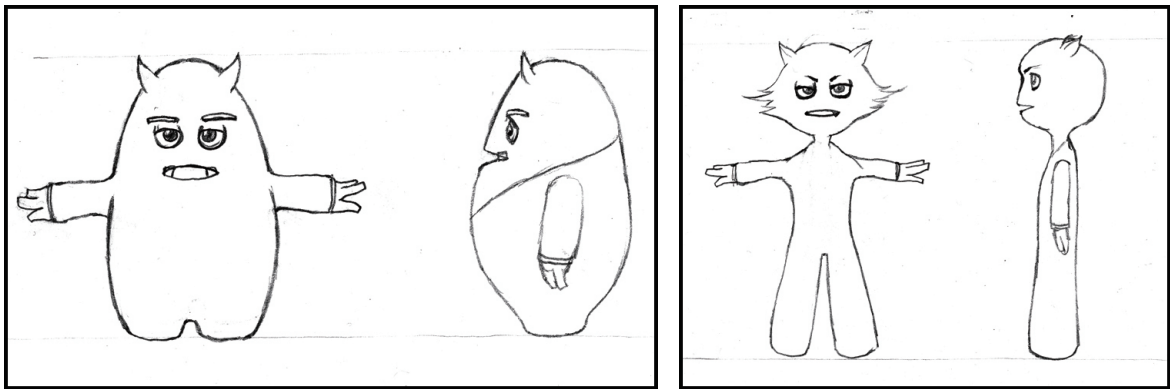
4.3 Modeling

After finishing the design, I had to model the two characters. Since I wanted to texture and animate them in 3D, the wireframes had to be correct. There were three important rules to follow.

1. Keep the number of faces as simple as possible. Doing so saves time when UV mapping and animating.
2. Maintain the STAR rule, that is, keep in mind the position of a verticle can not be located if it connects to five lines.
3. Make sure the model has enough segments in certain parts to be deformed in animation, such as elbow, whist, and knee.

The model was created in three steps:

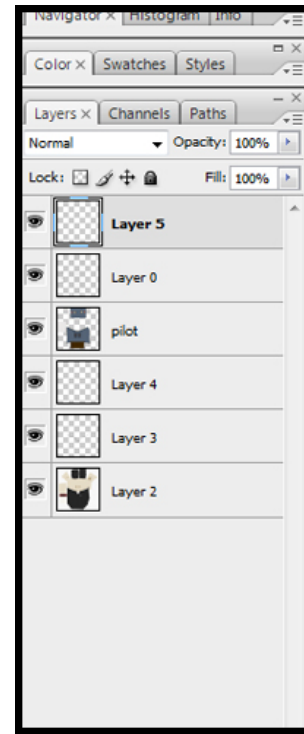
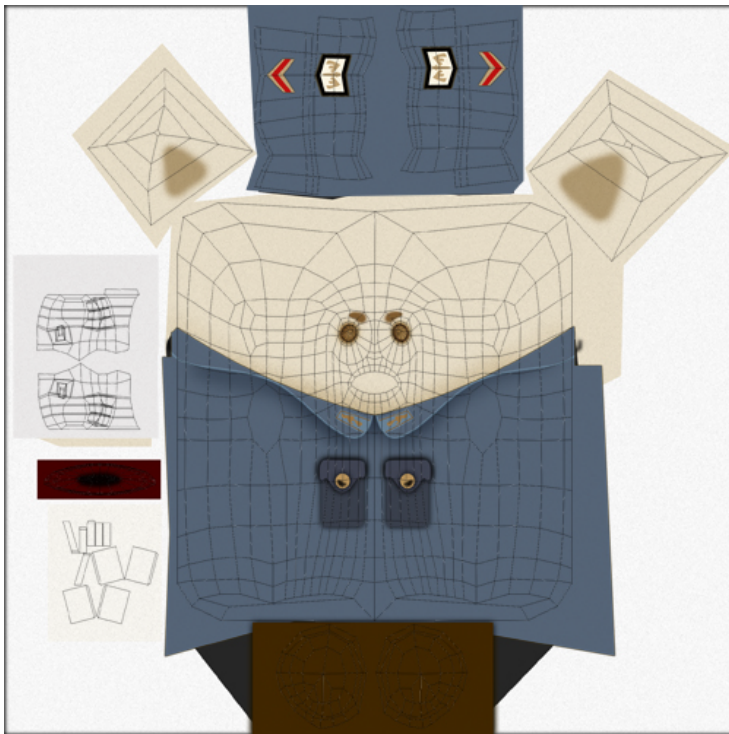
1. I drew the front view and the side view of the characters then scanned them for references.



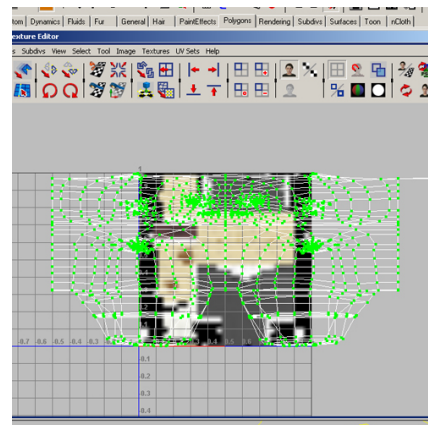
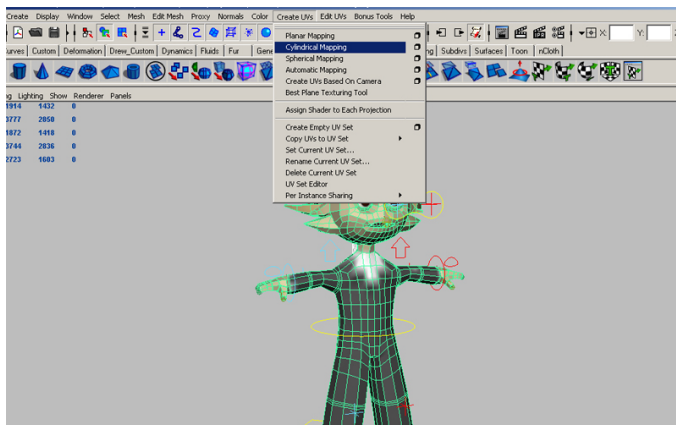
2. I built mass models using simple NURB objects because it was fast and very smooth.
3. I modeled the characters into polygons.

4.4 Texturing

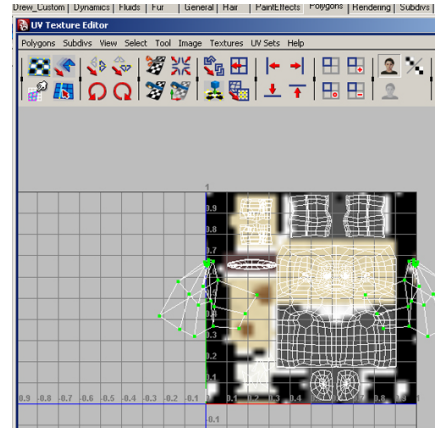
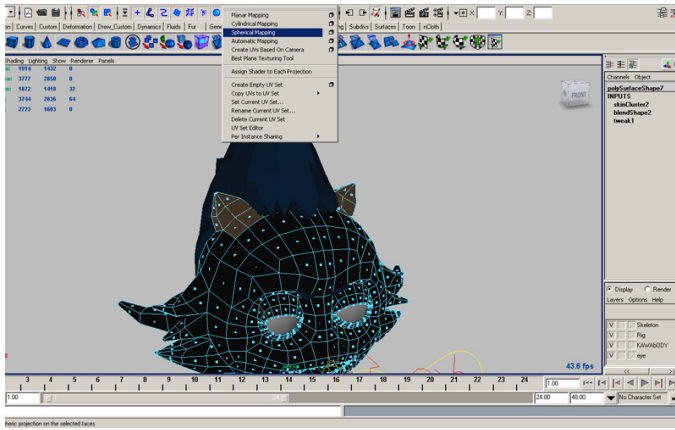
The characters are virtual idols. Unlike normal cartoon character having only one look, they have different appearances. To achieve this, UV mapping is very important. Cylindrical, Planar, and Spherical mapping are used to unwrap all the faces for the two characters. When the outUV image is done, patterns are created using Adobe Illustrator. Texture images are created in Adobe Photoshop.



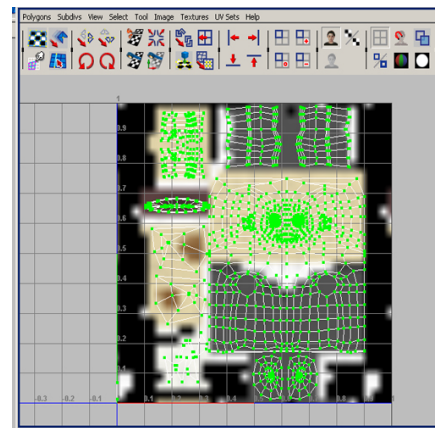
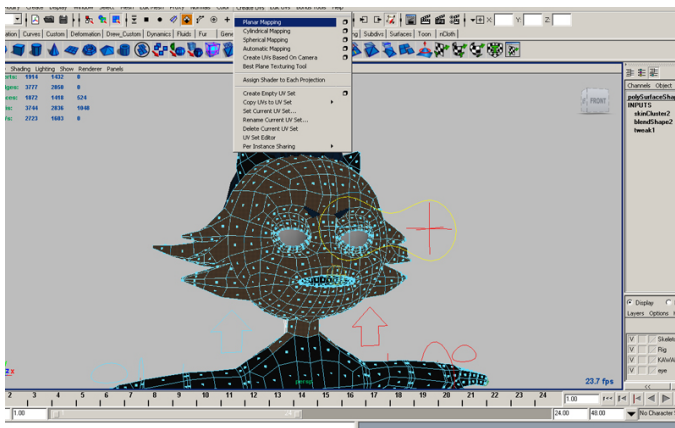
1. Assign a Cylindrical Mapping to the whole model.



2. Select the ears and use Spherical Mapping to unwrap the faces.



3. Select the faces of the FACE and use the Planar Mapping through the camera view.

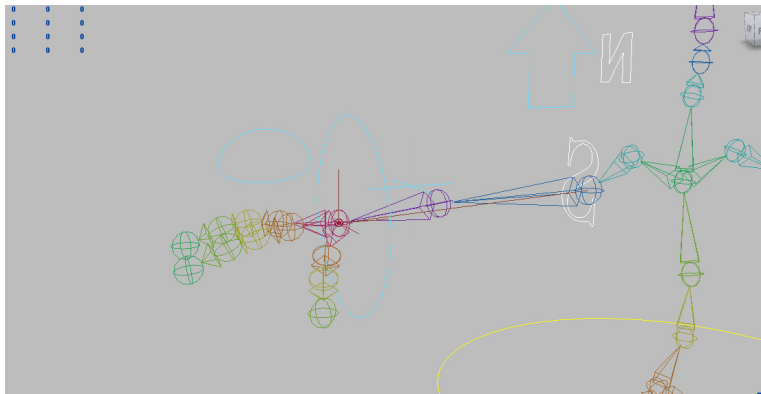


4.5 Rigging

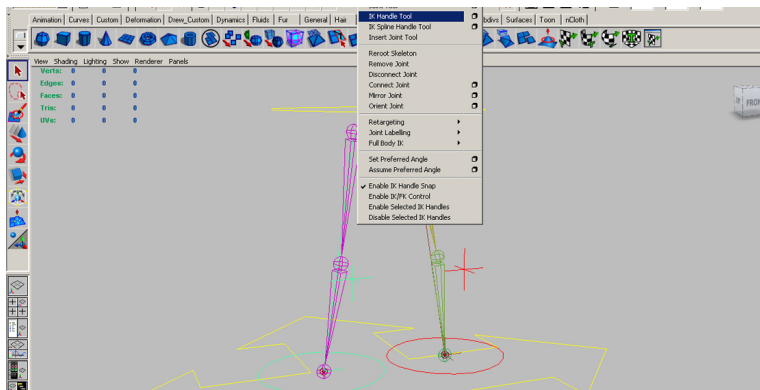
Rigging means to create the greatest flexibility for animating by setting up the skeleton system with IK handles and manipulator.

Rigging is one of the most important and tedious parts in character animation. When done correctly, rigging makes the animation work more than ten times easier. Even though the characters I did are not human, it is important to have the correct rigging system set up so the animation work can be performed a lot easier and faster.

1. For arms setup, I used IK system from the shoulder to the wrist, and then I used pole vector constraint to control the elbow.



2. For leg setup, I used IK system from the hip to the foot.



3. Skinning was the most tedious work of all. While skinning did not involve many technique tasks, the only challenge was concentration.

4.6 Blendshape

Blendshape is a very special deformer in MAYA. To make character animation more realistic, a deformer is used to blend the original character geometry with the geometry displaying the emotion you just created. That kind of deformer is called a blend shape deformer. Blend shapes are very useful in 3D, especially to animate facial expressions on characters. They can also be used for plenty of other things. For example, to animate a stroke growing and fading, the best approach is to use blend shape.

5. SHOW OPENING DESIGN

5.1 The Ones that Don't Work Out

In the spring quarter of 2008-2009 academic year, I tried to pass the first defense, but the two animations did not meet the requirements and expectations of my Committee Members. The two animations are both motion graphics pieces I did for the imagined show openings. I considered them as the first version of the openings for Dynamic Duo and Daily Gamer.

The first version of the Dynamic Duo opening was designed just to introduce the two characters with them imitating a lot of characters in the show. In this animation, I rendered out the 3D animation first then added 2D elements into the scene in AfterEffects. I did not know how to bring MAYA camera data into AfterEffects at the time. So to add 2D elements, I did not do very complicated camera movements in MAYA.

The first version of the Daily Gamer opening was designed more for giving the audience a very pleasing and exciting feeling. I rendered all the scenes using toon shading because I wanted it to have a kind of cartoon look. I designed the car chasing animation for both the desert environment and the temple one.

5.2 Reconsider

As I have mentioned in the section above, the two animations did not pass in the first defense. I took a short break after the defense. My Chief Advisor, Chris Jackson, recommended that I look at the thesis after a week and I would find something new.

After taking a look back on the two animations that I did before, I realized what did wrong. I did not expect to find so many things I should have avoided in my animation. The mistakes I made were actually different in the two openings. There were three things limiting the quality of the Dynamic Duo opening and there were another three parts that should have been changed in the Daily Gamer opening.

The first thing that required change was the camera movements. An advantage of 3D animation is the great and unlimited camera movements. In my first version of the Dynamic Duo opening, I did not use any wonderful camera movements. This caused the second problem, character animation.

Character animation was not my specialty. So when the camera stayed still, I spent a great deal of time animating the character and did not do such a good job. Common sense told me that it was only possible to do a great job at something I had a talent. The last thing I must do when creating the second version is to communicate to the audience the relationship between the two characters. This one was not achieved in the first version.

For the Daily Gamer opening, there were three serious mistakes. First, instead of giving the piece a cartoon look, the toon shading made the finished piece look like an "animatic" quality animation.

Second, even in motion graphics works, storytelling was needed as animation is considered a type of motion graphics. Specifically, the first version of the Daily Gamer opening appeared more like a 3D animation than a motion graphics piece. The last one was that the animation was not really related to the title "Daily Gamer".

After reconsidering both projects, I now had a clear view of what needs to be done to make the two pieces much better. Prior to starting the new versions, I added one additional task to my schedule, that is, to check the animations as audience once a week as I believe it is one of the reasons how the motion graphics projects can make sense.

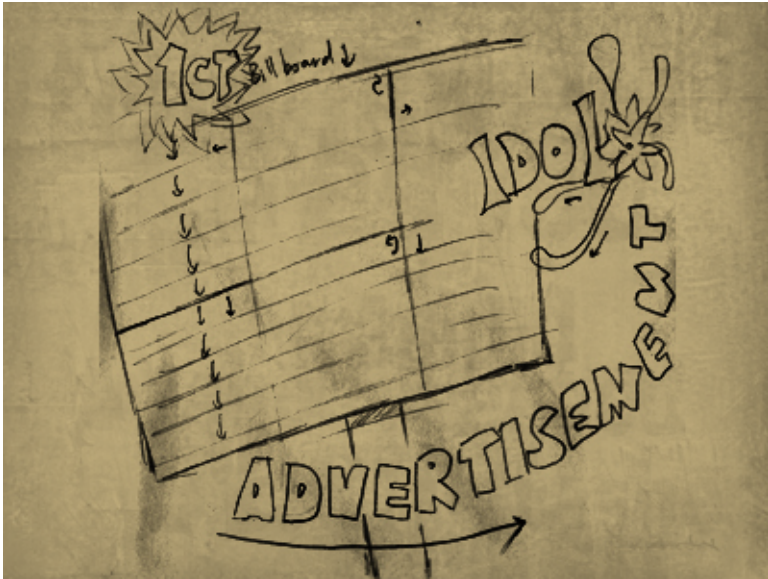
5.3 Storyboard of Dynamic Duo

When a motion graphics studio starts a certain project, the most important thing is to do it according to the boards that approved by clients. The good thing is that after the boards are approved, the animators have a very clear direction in guiding the project. The disadvantage is that the animators cannot add new ideas when doing the animation. In this case, I decided to do the storyboard in sketch and use quick rendered frames to set the colors.

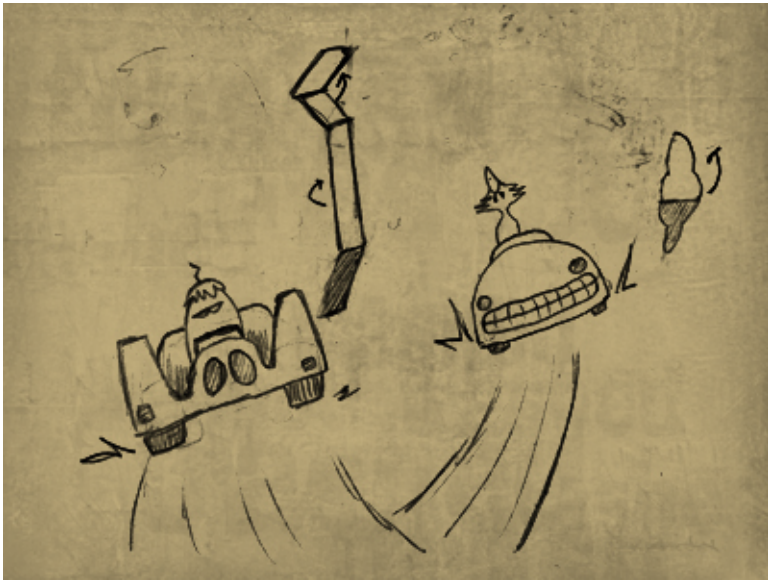
For the second version of the Dynamic Duo opening, I made three rules for myself to follow so I do not go to the wrong direction. First, ensure that the two characters are in the scene for most of the time. This engages the audience and ensures their understanding of the idea being delivered. The second thing is to watch the pace of the animation to ensure camera movement is quick and cool. Finally, make the animation as interesting as possible. This means I should have a lot of different things going on in one scene.



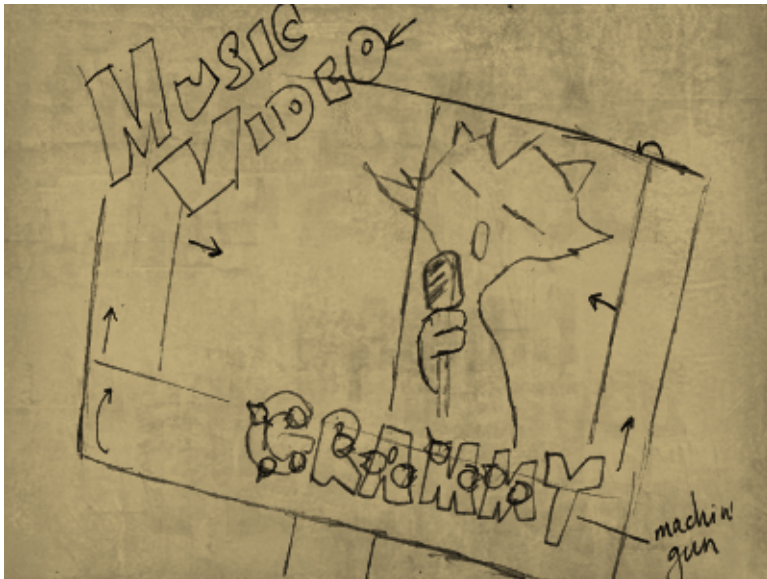
(1) The scene starts from the camera following the two cars.



(2) The first board built up showing Vinny doing the advertisement.



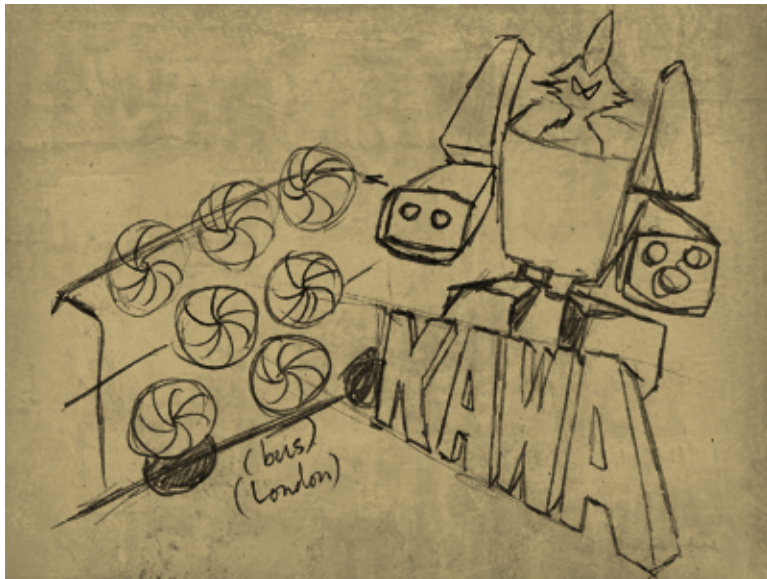
(3) The third shot is the cars coming towards the camera.



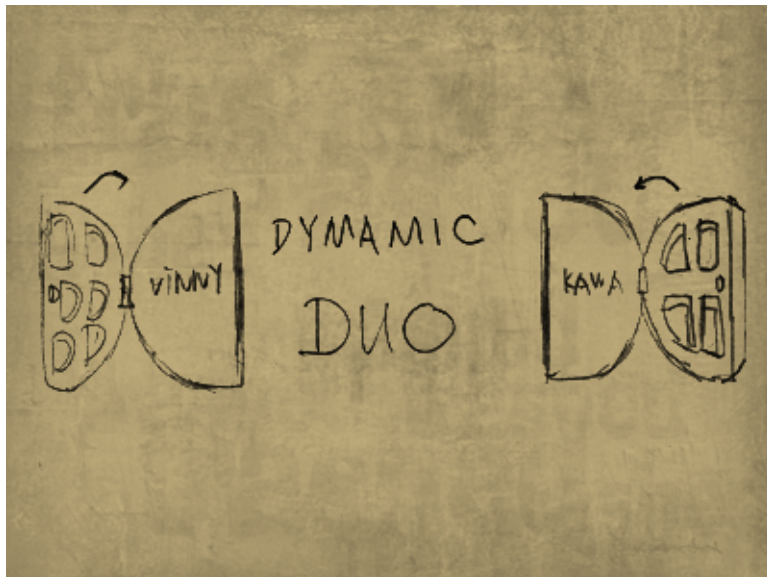
(4) The second board built up showing Kawa doing Music Video.



(5) After the second board, I am showing the robots. First, it's the Vinny's one.



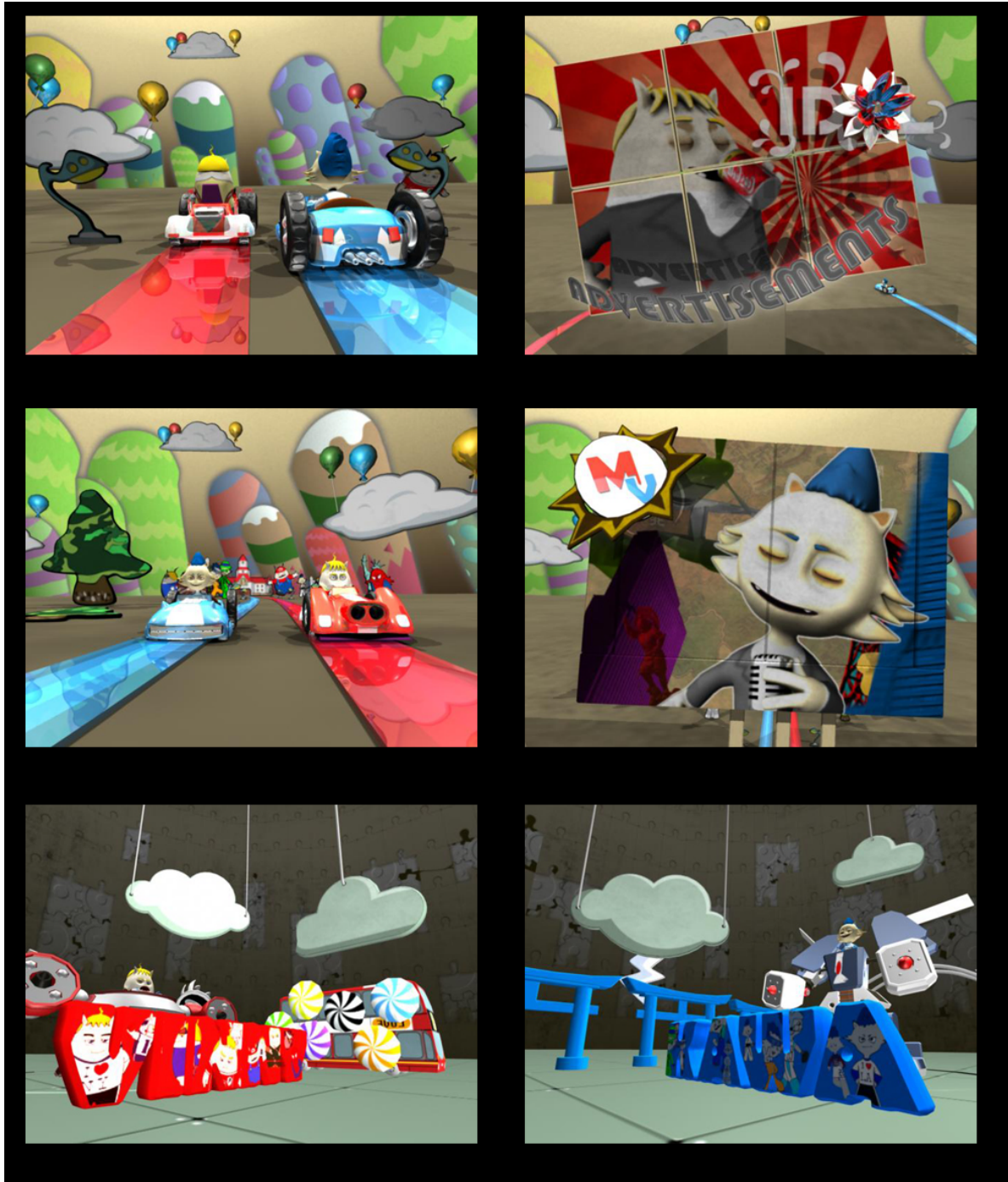
(6) After showing Vinny's robot, the camera turns right and reveals Kawa's robot.



(7) Camera moves up and title shows up.

5.4 Style Frames for Dynamic Duo

This process is named style frames in motion graphics, but I prefer to call it color setting in my projects. Since I did not have a super computer to work on and I had a deadline to meet, I could not spend too much time on setting the look. That's why instead of rendering out the exact look of the project using final gathering, I simply used MAYA's software render to decide the colors.



5.5 Animation Tasks

There are two major kinds of animations in MAYA. The easier and most common one is animating the transform node. The other one is animating the shape node, also known as changing shapes.

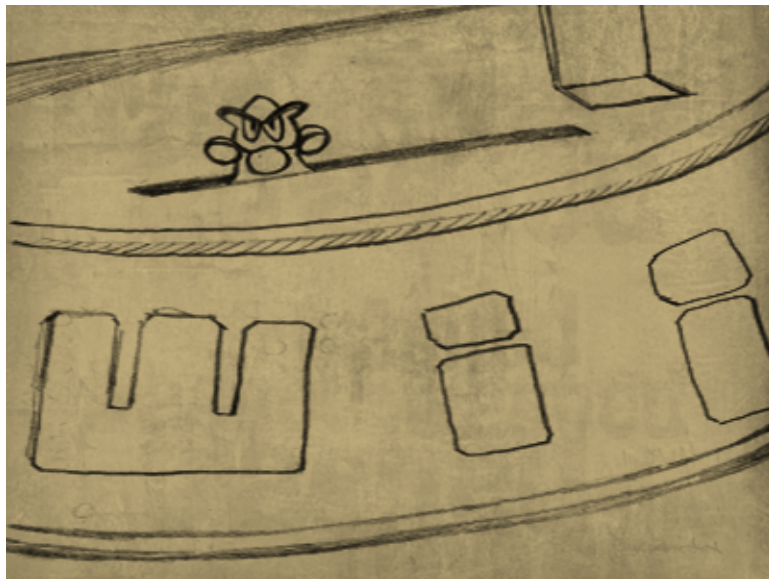
01. I used motion path and flow animation to create the growing animations in the Dynamic Duo opening. There is a lot of this kind of animations in this piece, with the one worth noting being white flower one. Since all the pieces are part of the flower prior to stretching, I modeled it carefully to verify the shape and the segment numbers in order to obtain the right result. Upon completion, I used motion path and flow animation to control the growing.

02. My favorite part of this piece is the animations on the animated board. While it is not too hard to achieve, it did need very organized pre-production. First of all, I needed to model the parts of the board separately, but gave them the same UV mapping to map the video on it correctly. The second step was animating the characters in MAYA and rendering it out as an image sequence. The next step was to create the video clip, which was mapped on the board in AfterEffects. The last step was mapping the image sequence rendered in AfterEffects to the board in MAYA.

5.6 Storyboard of Daily Gamer

For the second version of the Daily Gamer opening, I decided to make the animation closer to the name so I brought four classic game elements into the piece. All four of them were games published more than 15 years ago. There was no problem in using them as I designed them in a different way. In that way, they matched better for the whole project.

The four games I picked were Super Mario Bros, Contra Force, Galaxian and Battle City. I was thinking about making this piece in the way Superfad, one of the top motion graphics studios, did in their Playstation three commercial. Ultimately though I changed to the football shape idea which meant to divide the football shape object into four stages for each of the game I mentioned above.



(1) The animation starts from the side of the football shape stage.



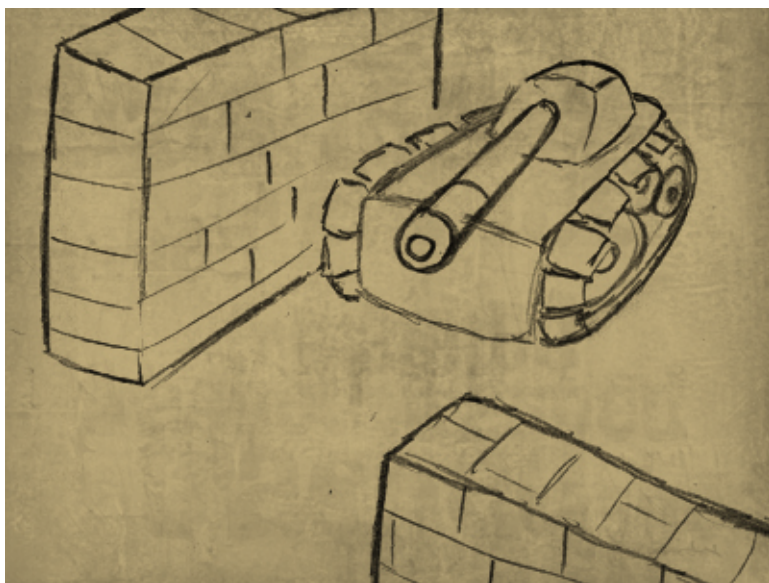
(2) The first stage is showing the game “Super Mario Bros”



(3) The football shape stage then turns and shows the second game “Contra Force”



(4) The third stage that is showed in this animation is the “Galaxian” with Vinny operating a jet.



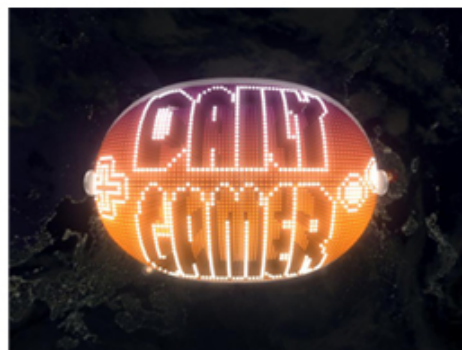
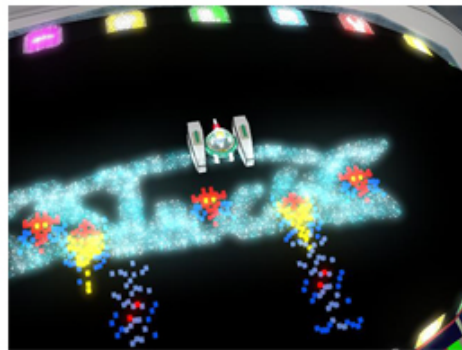
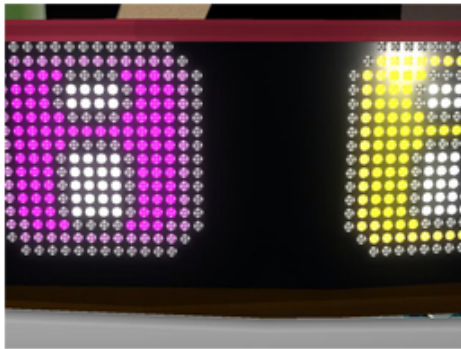
(5) The last game is “Battle City” and Kawa is driving a tank in this scene.



(6) In the end, the title of the show will be revealed on the football.

5.7 Style Frames for Daily Gamer

The color setting for this piece had its own advantage and disadvantage. Since the whole piece was divided into four parts according to the four games, it was easier for me to do the color setting for each of the pieces. As you can see, however, I did all the four parts differently so there was much more work to do. In the previous Daily Gamer opening, I used toon shading with ambient occlusion path, but ended up having the animatic quality look. This time, I simply used lambert (basic maya material) and focused more on giving the piece a variety of colors.



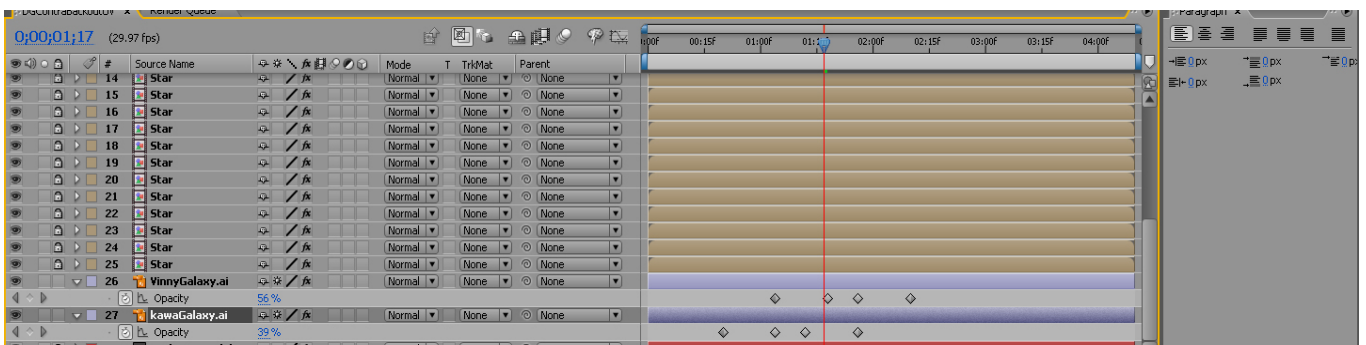
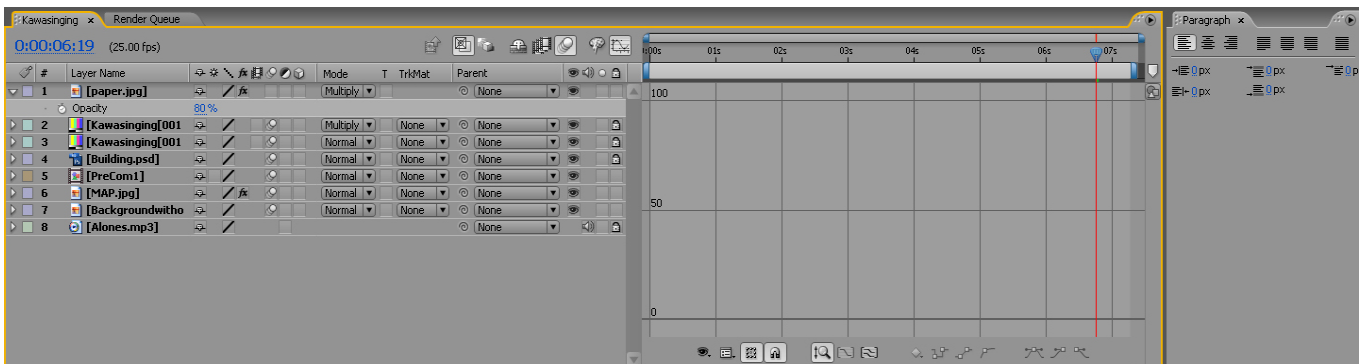
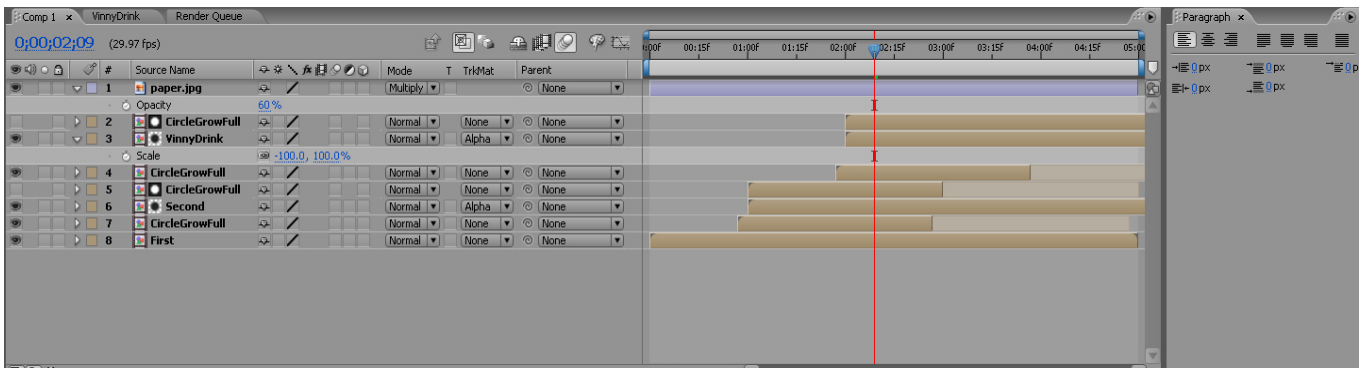
5.8 Animation Tasks

I learned two very important skills when doing this animation. One was the use of setting-driven keys. The other was using simple expressions to do animations. I have learned and used set-driven key a great deal in the past in many of my other projects, but I used it primarily for finger animation. In this piece, I used this controller to do the animations of the boards, which could be folded and stretched. First of all, I changed all the anchor points to the place I wanted for my animation. Then I parented the objects to my skeleton system. After that, I created a circle and added attribute for setting driven keys.

There was a part that I designed having a lot of cubes accumulating and forming the shape of the alien, which appeared in the game Galaxian. The animation is very simple, but it was almost impossible to animate the cubes one by one. In this case, I used expression to control the translation attribute.

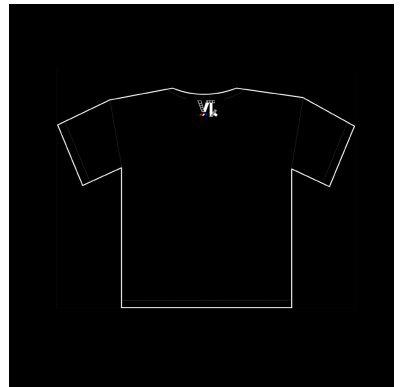
5.9 Compositing

I used After Effects to composite all the image sequences rendered out from MAYA and did the color correction. There were three to four layers for each scene. The bottom one was the original color layer. Above it was the ambient occlusion path in the multiply layer mode. I duplicated the original final gathering layer and placed it on the top using the screen layer mode. In some of the scenes I added an overlay mode layer to increase the depth to the project.



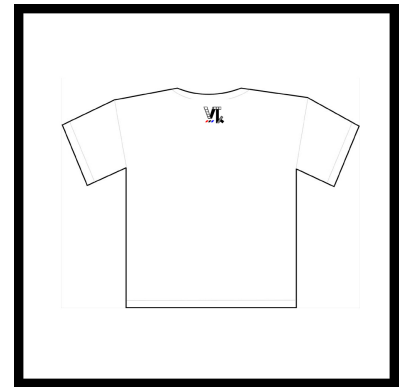
PRODUCT DESIGN

6.1 T-shirts (black)



I have done three versions of black t-shirts and three white ones and I hope that I can finally make these two characters into really popular virtual idols so that I can design more products for them.

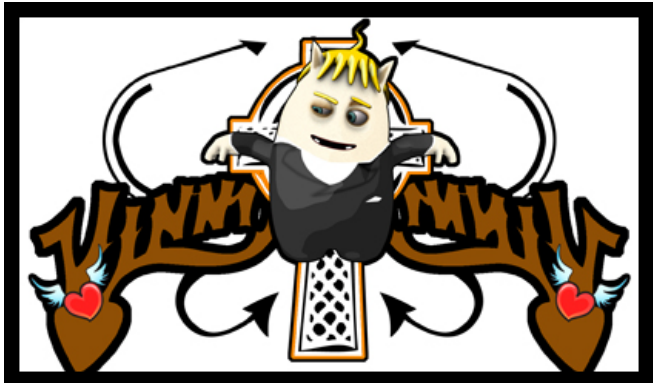
6.1 T-shirts (white)



6.2 Key Chains

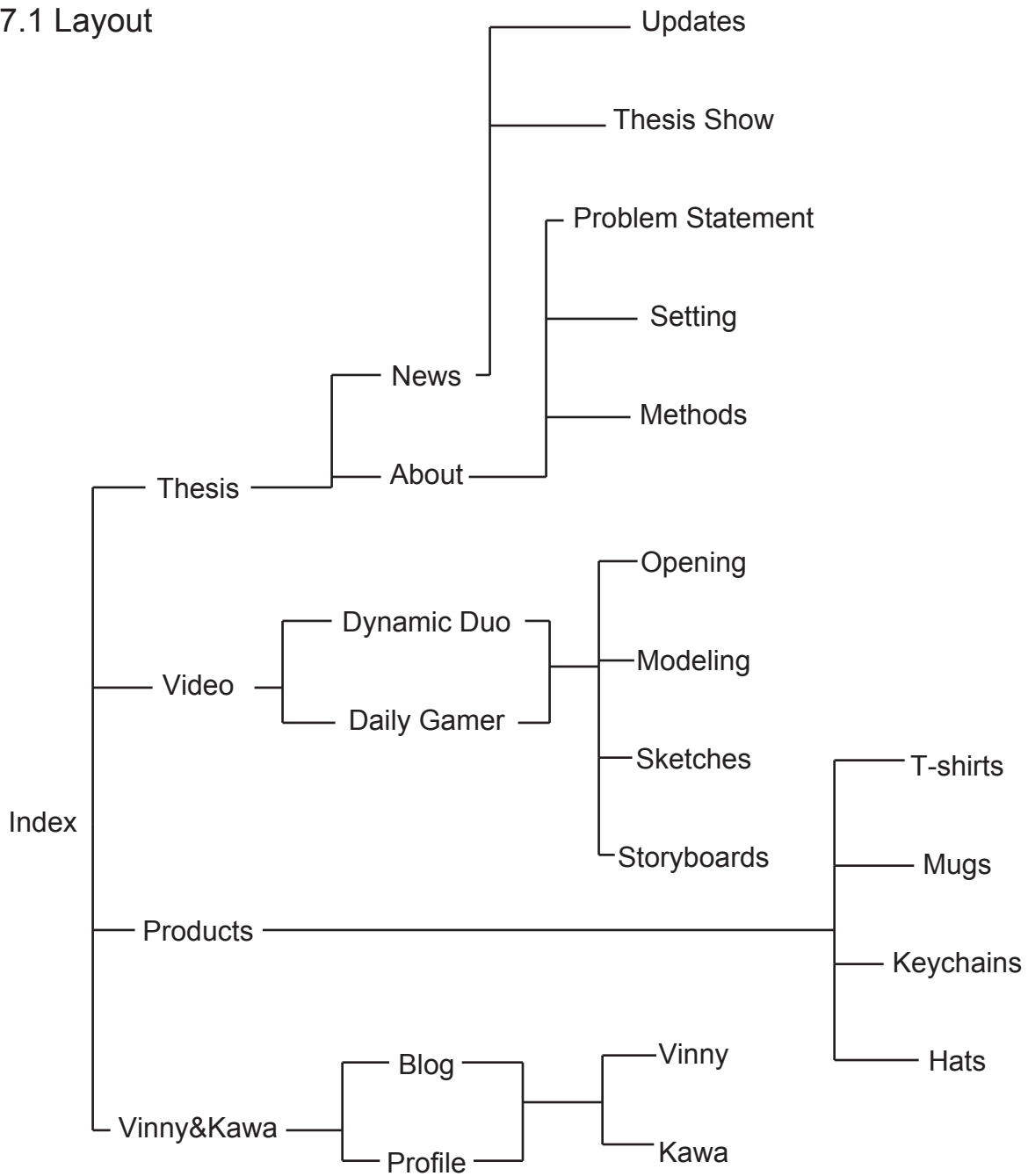


6.3 Mugs



7. WEB DESIGN

7.1 Layout



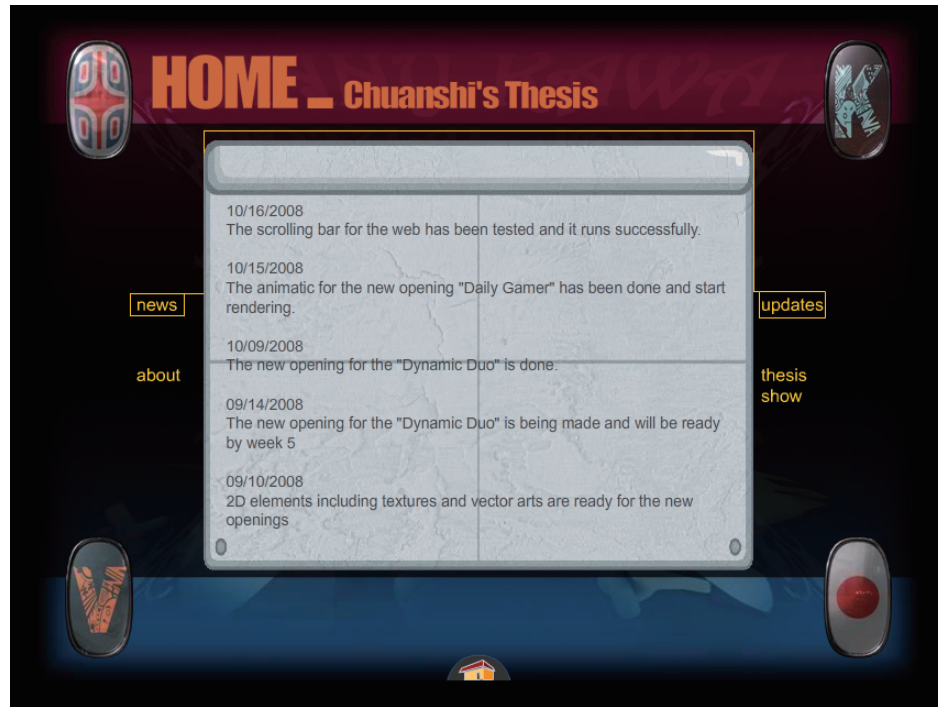
7.2 User Interface

The web is a part of the promotion package so I decided to give it a unique look which should be quite different from most of the websites. Since the web consists of four aspects, I decided to give each of them a different look with the same style.

The design of the index page was made very early because I wanted to use the four 3D button I created.



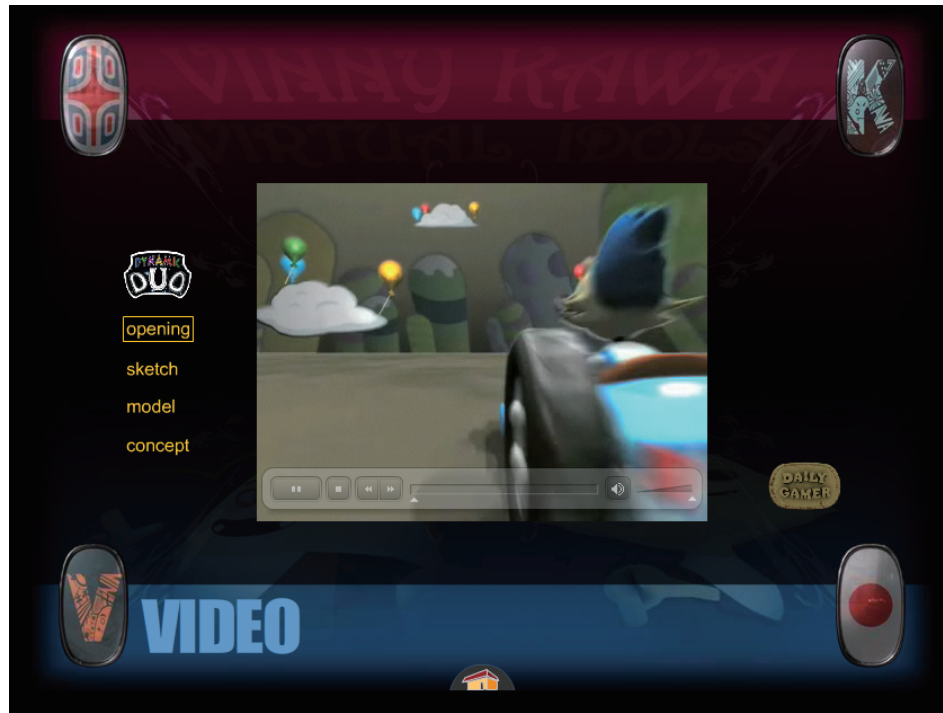
1. I designed this part to explain what my thesis is about. I made it into a scroll look page so that the audience can notice what it is about just by the look of the page.



2. I made the products part look like the assembling line in a factory.



3. The video part was designed into a stage looking page.



4. The blog and Biography page was made into a digital notepad .



8. THE LITERATURE SURVEY

Official Autodesk Training Guide

Learning Autodesk Maya 2008

By Marc-Andre Guindon

Published 2007 Autodesk, Inc

ISBN 9781897177389

Summary

Autodesk published this official training guide book for students whose majors are computer graphics, 3D animation and other related fields. This book moves at a fast pace and is designed to help the intermediate level user improve their modeling and animation skills and understand how they related to one another in a production pipeline. This book covers almost all the processes an animation needed to be finished. This book consists of six parts, modeling, texturing, rigging, skinning, deformers and animation basics.

Solution

This book is a very handy one for me mostly because of the rigging part, which is chapter four in the book. It covers all the aspects of the rigging including IK setup, constraints and Joint Orientation.

After Effects in Production

A Companion for Creating Motion Graphics

After Effects in Production

A Companion for Creating Motion Graphics

By Trish Meyer and Chris Meyer

Published 2004 Group West

ISBN 1578200776

Summery

This book was designed for people who already have some experience using Adobe After Effects. Its goal is to help students build on that experience by sharing a number of tricks and techniques in an artistic context. There are a lot of tutorials in this book and all these tutorials are based on different projects. Each tutorial follows its own path.

Solution

Since the two motion graphics pieces I did in my thesis are 3D animation, there's not too much I can use directly from the tutorials in this book. But in chapter two, I learned a lot about compositing and post production, including color correction and the use of different layer modes.

Maya Visual Effects : The Innovator's Guide

By Eric Keller

Published 2008 Autodesk MAYA Press

ISBN 9780470111338

Summary

This book is designed to help students move beyond the basics so that they feel comfortable innovating when creating effects with Maya. Every tool in Maya has three or four common uses and about a billion possibilities for uncommon solutions.

Solution

I learned how to do the smoke in MAYA so that I can add it in the Dynamic Duo opening piece and the bullet effect in the Daily Gamer piece.

9. CONCLUSION

9.1 Feedback

Just like what I have stated in my proposal, I showed my website to the exact target audience I decided before, including people who knows design well and people who is totally learning different things like engineering. The successful part is almost everyone likes the two characters, as well the show openings. One of them even told that he really wants to see the two characters hosting the TV shows.

One thing that I think I need to improve in the future is how to get people know what I am doing more easily. My friend Xiang Li helped me a lot during the time I was doing this project. Since he didn't know anything about animation or design, he was giving comments as a random audience so I can keep my thesis understood by people not in the same field as me.

Questions asked most

1. Why don't you use human charaters?

Answer: Human characters are not too proper for being virtual idols because we already have a lot of real idols.

2. Why don't you do a fight scene between the two?

Answer: I think it is a great idea, and I will try to do that later.

3. Are you going to make more character?

Answer: Of course, Vinny and Kawa are going to have a few friends.

9.2 Prospect

Even for my thesis, these two characters are virtual idols, I want to make them the mascots for my own company which hopefully can be founded in 5 to 10 years. I will definitely make a demo of the TV show and let both the audience and the character have some fun.

I have started writing scripts for these two characters and my goal is to create a series of projects using these two characters as leading roles. This is like making a campaign.

9.3 My achievement

I think what I have learned most in doing this project is starting looking at my own project as my audience. All of my committee members, especially Prof. Jackson helped me a lot with this.

Besides improving my design and technique skills by working on my thesis, I have learned a lot about communication and the way to take advice. All my committee members helped me on doing this with all of their effort and I've learned so much from them. They were all very kind to me and they taught me the best way of giving advice and taking advice.

10. BIBLIOGRAPHY

10.1 Publication

Official Autodesk Training Guide - Learning Autodesk Maya 2008

After Effects in Production - A Companion for Creating Motion Graphics

10.2 World Wide Web

Wikipedia (<http://en.wikipedia.org>)

CreativeCow (<http://www.creativecow.com>)

CG society (<http://www.cgsociety.org>)

10.3 Hardware

PC Alienware

Processor: 3.2GHz AMD

Memory: 4 G

Operating System: Windows XP64

10.4 Software

Adobe Photoshop CS3

Adobe Illustrator CS3

Autodesk MAYA 2008

Adobe Flash CS3

Adobe After Effects 8.0